

Appln. No.: 09/774,347
Preliminary Amendment Dated July 24, 2003

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Amendments to the Claims: This listing of claims will replace all prior versions, and listings, of claims in the application

Listing of Claims:

1. (Currently Amended) A head support mechanism, including:

a slider having for carrying a magnetic head attached thereto, at least for recording
performing reproduction of data to and/or reproducing data from a magnetic disk; and

a holding portion slider holding plate for holding the slider;

wherein the holding portion includes:

a first portion including a first pair of substrates each having a piezoelectric element
attached thereto;

elastic hinges for connecting the slider holding plate and the pair of substrates; and

a dimple for supporting the slider holding plate such that the slider holding plate is
rotatable in all directions.

wherein the slider is rotated in a minutes scale around the dimple by contraction and
expansion of at least one of the piezoelectric elements.

— a second portion including a second piezoelectric element;

— a third portion connected to the first and second portions, the slider being
provided on the third portion; and

— a fixing portion for fixing the first and second portions, and

at least one of the first and second piezoelectric elements is contracted and expanded in
a direction substantially parallel to a surface of the disk, in the presence of an applied voltage
so that the slider provided on the third portion is rotated around a predetermined center of
rotation.

2. (Canceled)

3. (Canceled)

4. (Canceled)

5. (Canceled)

6. (Canceled)

7. (Canceled)

8. (Canceled)

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9. (Canceled)

10. (Canceled)

11. (Canceled)

12. (Canceled)

13. (Canceled)

14. (Canceled)

15. (Withdrawn) A head support mechanism, including:

a slider for carrying a head at least for performing reproduction of data from a disk; and

a holding portion for holding the slider,

wherein the holding portion includes:

a first portion including a first piezoelectric element;

a second portion including a second piezoelectric element; and

a fixing portion for fixing the first and second portion, and

at least one of the first and second piezoelectric elements is contracted and expanded in a direction substantially parallel to a surface of the disk, in the presence of an applied voltage so that the slider is rotated around a predetermined center of rotation, and

the head support mechanism further includes:

a load beam provided at a side of the holding portion opposite to the slider; and

a slider holding plate provided between the holding portion and the load beam and provided at a position corresponding to the slider;

wherein:

the load beam includes a dimple projecting toward the slider in such a manner as to press the third portion via the slider holding plate; and

the slider holding plate has such a shape that the center of gravity of a combination of the slider holding plate and the slider substantially corresponds to the predetermined center of rotation.

16. (Withdrawn) A head support mechanism according to claim 15, wherein:

the holding portion further includes a third portion, the slider being provided on the third portion; and

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at least one of the first and second piezoelectric elements is contracted and expanded in a direction substantially parallel to the surface of the disk, in the presence of applied voltage so that the third portion is rotated around the predetermined center of rotation.

17. (Withdrawn) A head support mechanism according to claim 15, wherein:

the holding portion includes a first joining portion for joining the first and third portions, and a second joining portion for joining the second and third portions; and

the dimple is provided at a substantially middle point between the first and second joining portions.

18. (Withdrawn) A head support mechanism according to claim 15, wherein the slider is rotated on the dimple corresponding to the predetermined center of rotation.

19. (Withdrawn) A head support mechanism according to claim 15, wherein the second portion is provided in such a manner that a distance between the second portion and the surface of the disk is substantially equal to a distance between the first portion and the surface of the disk.

20. (Withdrawn) A method for producing a thin film piezoelectric element, including the steps of:

a) forming a first metal electrode film, a first thin film piezoelectric element, and a second metal electrode film on a first substrate in this order;

b) forming a third metal electrode film, a second thin film piezoelectric element, and a fourth metal electrode film on a second substrate in this order;

c) attaching the second metal electrode film to the fourth metal electrode film;

d) removing the first substrate by etching;

e) shaping the first metal electrode film, the first thin film piezoelectric element, the second metal electrode film, the fourth metal electrode film, the second thin film piezoelectric element, and the third metal electrode film;

f) covering the first metal electrode film, the first thin film piezoelectric element, the second metal electrode film, the fourth metal electrode film, the second thin film piezoelectric element, and the third metal electrode film, with a coating resin; and

g) removing the second substrate by etching.

21. (Withdrawn) A method according to claim 20, wherein the first and second substrates are each a mono-crystal substrate.

22. (Withdrawn) A method according to claim 20, wherein:

the linear expansion coefficient of the first substrate is greater than the linear expansion coefficient of the first thin film piezoelectric element; and

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the linear expansion coefficient of the second substrate is greater than the linear expansion coefficient of the second thin film piezoelectric element.

23. (Withdrawn) A method according to claim 20, wherein step c) includes attaching the second metal electrode film to the fourth metal electrode film using a conductive adhesive.

24. (Withdrawn) A method according to claim 20, wherein step c) includes attaching the second metal electrode film to the fourth metal electrode film using a thermal melting technique using ultrasonic vibration.

25. (Withdrawn) A method according to claim 20, wherein:

step a) includes forming the first thin film piezoelectric element in such a manner that a polarization direction of the first thin film piezoelectric element substantially corresponds to a direction perpendicular to a surface of the first thin film piezoelectric element; and

step b) includes forming the second thin film piezoelectric element in such a manner that a polarization direction of the second thin film piezoelectric element substantially corresponds to a direction perpendicular to a surface of the second thin film piezoelectric element.

26. (Withdrawn) A thin film piezoelectric device, including:

a first metal electrode film;

a first thin film piezoelectric element provided on the first metal electrode film;

a second metal electrode film provided on the first thin film piezoelectric element;

a third metal electrode film;

a second thin film piezoelectric element provided on the third metal electrode film;

a fourth metal electrode film provided on the second thin film piezoelectric element; and

adhesive means for attaching the second metal electrode film to the fourth metal electrode film.

27. (Withdrawn) A thin film piezoelectric device according to claim 26, further including voltage applying means for applying a voltage to the thin film piezoelectric device, wherein the voltage applying means includes;

a first terminal for applying a driving voltage to the first and third metal electrode films;
and

a second terminal for grounding the second and fourth metal electrode films.

28. (Withdrawn) A head support mechanism, including:

a slider for carrying a head; and

a holding portion for holding the slider,

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wherein the holding portion includes:

- a first portion including a first piezoelectric element;
- a second portion including a second piezoelectric element;
- a third portion connected to the first and second portions, the slider being provided on the third portion; and
- a fixing portion for fixing the first and second portions, and

the first and second piezoelectric elements include a thin film piezoelectric device according to claim 26.

29. (New) A head support mechanism according to claim 1, wherein each of the pair of substrates is stacked on the corresponding piezoelectric element, and at least one of the pair of substrates is bent by a bimorph effect accompanying the contraction and expansion of at least one of the piezoelectric elements, so as to minutely rotate the slider holding plate.

30. (New) A head support mechanism according to claim 1, wherein the dimple is provided in a tip portion of a load beam for supporting the slider holding plate.

31. (New) A head support mechanism according to claim 30, wherein the load beam includes a pair of regulation portions for regulating the rotation of the slider holding plate.

32. (New) A head support mechanism according to claim 1, wherein root portions of the pair of substrates are integrally formed.

33. (New) A head support mechanism according to claim 1, wherein the pair of substrates and the elastic hinges are formed of an identical material.

34. (New) A head support mechanism according to claim 1, wherein:
the slider has an air bearing surface so as to face the magnetic disk,
the air bearing surface forms an air lubricating film between the magnetic disk and the slider while the magnetic disk is rotating, and
the slider is rotated around a center position of the air bearing surface by the contraction and expansion of at least one of the piezoelectric elements.

35. (New) A head support mechanism according to claim 1, wherein the pair of substrates and the piezoelectric elements are coated with a resin so as to be integrated together.

36. (New) A head support mechanism according to claim 1, wherein the pair of substrates and the elastic hinges have a conductor pattern for transferring a recording signal and a reproduction signal to and from the magnetic head attached thereto.

37. (New) A head support mechanism, comprising:

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a slider having a magnetic head attached thereto, for recording data to and/or reproducing data from a magnetic disk;

a substrate having a slider attachment portion, a pair of conductor substrate portions, and a pair of elastic hinge portions for connecting the slider attachment portion and the pair of conductor substrate portions, respectively;

a slider holding plate for holding the slider via the slider attachment portion of the substrate;

piezoelectric elements attached to the pair of conductor substrate portions; and

a load beam for supporting the slider holding plate via a dimple provided in a tip portion thereof, such that the slider holding plate is rotatable in all directions,

wherein the slider is rotated in a minutes scale around the dimple by contraction and expansion of at least one of the piezoelectric elements.

38. (New) A head support mechanism according to claim 37, wherein each of the pair of conductor substrate portions of the substrate is stacked on the corresponding piezoelectric element, and at least one of the pair of conductor substrate portions is bent by a bimorph effect accompanying the contraction and expansion of at least one of the piezoelectric elements, so as to minutely rotate the slider holding plate.

39. (New) A head support mechanism according to claim 37, wherein root portions of the pair of conductor substrate portions are integrally formed.

40. (New) A head support mechanism according to claim 37, wherein:

the slider has an air bearing surface so as to face the magnetic disk,

the air bearing surface forms an air lubricating film between the magnetic disk and the slider while the magnetic disk is rotating, and

the slider is rotated around a center position of the air bearing surface by the contraction and expansion of at least one of the piezoelectric elements.

41. (New) A head support mechanism according to claim 37, wherein the load beam includes a pair of regulation portions for regulating the rotation of the slider holding plate.

42. (New) A head support mechanism according to claim 37, wherein the pair of conductor substrate portions of the substrate and the piezoelectric elements are coated with a resin so as to be integrated together.

43. (New) A head support mechanism according to claim 37, wherein the pair of conductor substrate portions and the pair of elastic hinge portions have a conductor pattern for transferring a recording signal and a reproduction signal to and from the magnetic head attached thereto.